

UNCLASSIFIED

AD NUMBER

AD046329

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Gov't. agencies and their contractors;  
Administrative/Operational Use; JUN 1953. Other requests shall be referred to Office of Naval Research, Washington, DC.

AUTHORITY

ONR ltr dtd 26 oct 1977

THIS PAGE IS UNCLASSIFIED

UNCLASSIFIED

AD NUMBER

AD046329

CLASSIFICATION CHANGES

TO:

unclassified

FROM:

confidential

AUTHORITY

30 jun 1965, DoDD 5200.10 per OCA, 11 Jun 1965

THIS PAGE IS UNCLASSIFIED

# UNCLASSIFIED

---

## AD \_\_\_\_\_

*Reproduced  
by the*

ED SERVICES TECHNICAL INFORMATION AGENCY  
ARLINGTON HALL STATION  
ARLINGTON 12, VIRGINIA



DOWNGRADED AT 3 YEAR INTERVALS:  
DECLASSIFIED AFTER 12 YEARS  
DOD DIR 5200.10

---

# UNCLASSIFIED

# Armed Services Technical Information Agency

Because of our limited supply, you are requested to return this copy WHEN IT HAS SERVED YOUR PURPOSE so that it may be made available to other requesters. Your cooperation will be appreciated.

AD

46329

NOTICE: WHEN GOVERNMENT OR OTHER DRAWINGS, SPECIFICATIONS OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE U. S. GOVERNMENT THEREBY INCURS NO RESPONSIBILITY, NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

Reproduced by  
DOCUMENT SERVICE CENTER  
KNOTT BUILDING DAYTON 2 OHIO

46329  
FILE COPY

# ~~Aerojet-General~~ CORPORATION

AZUSA, CALIFORNIA

---

## IN F O R M A L   R E P O R T   O F   P R O G R E S S

---

Copy No. 6

11 June 1953

TO: Office of Naval Research  
Department of the Navy  
Washington 25, D. C.

VIA: Bureau of Aeronautics Representative  
Aerojet-General Corporation  
6352 N. Irwindale  
Azusa, California

SUBJECT: Research, Development, and Testing  
of Underwater Propulsion Devices

CONTRACT: N6ori-10, Task Order I  
Project NR 220 003

PERIOD  
COVERED: 1 May through 31 May 1953

This informal monthly progress report is  
submitted in partial fulfillment of the  
contract.

AEROJET-GENERAL CORPORATION

*C. A. Gongwer*  
C. A. Gongwer, Manager  
Underwater Engine Division

NOTE: The information contained herein is regarded as preliminary  
and subject to further checking, verification, and analysis.

---

This document contains information affecting the national defense of the United States within the meaning of the Espionage laws, Title 18, U.S.C., Sections 793 and 794. The transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

---

CONFIDENTIAL  
SECURITY INFORMATION  
54A

THIS REPORT HAS BEEN DELIMITED  
AND CLEARED FOR PUBLIC RELEASE  
UNDER DOD DIRECTIVE 5200.20 AND  
NO RESTRICTIONS ARE IMPOSED UPON  
ITS USE AND DISCLOSURE.

DISTRIBUTION STATEMENT A

APPROVED FOR PUBLIC RELEASE;  
DISTRIBUTION UNLIMITED.

**NOTICE: THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE  
NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING  
OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 and 794.  
THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN  
ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.**

## I. TEST VEHICLE MOTOR USING 3.75-IN.-DIA GRAIN

A. Work is continuing on the improvement of the low-L\* combustion chamber for the hydroductor. Turbulators made from a number of materials were tried and gave varied results. The best results were obtained with a turbulator button made of carbon. The button seems almost unaffected by the hot gases and gives thorough mixing with corresponding improvement of performance. All indications point to a satisfactory solution of the combustion chamber problems for the free-running hydroductor.

B. In order to improve the overall efficiency of the free-running hydroductor, a series of tests to determine the best configurations have been initiated on the static hydroductor test stand. The condensing chamber parameters are being varied and optimum points obtained.

C. The regular program of proof-checking the test-missile grain production continues. At least one out of every four grains pressed is static-tested to check performance.

D. Two grains have been static-tested after having been subjected to accelerations of 300 g. The runs were completely satisfactory and performance was consistent with previous tests.

E. The static test facility has been improved to allow variations in water-entry time delay. This will allow closer control and tests to determine the best sequencing procedure to simulate more closely the actual firing of a free-running test missile.

F. A total of forty-nine runs were made on the static-motor thrust stand.

## II. ALCOLO-FIRED TEST STEAM GENERATOR

A. The steam generator was operated in a closed cycle. Mechanical difficulties in feeding the solid grain permitted operation for a total of only 2 minutes.

B. To all appearances the unit itself performed satisfactorily. A small quantity of smoke escaped from the furnace, but air leaks in the suction side of the cycle are being closed to prevent this. The bottom of the furnace has retained a considerable amount of KCl slag and loose ash; this keeps the troublesome portion of the combustion products from reaching other parts of the cycle. The boiler acquired a light coating of ash, which is to be expected and which, so far, does not appear detrimental to its operation. The dust collector removed a quantity of fly-ash ranging in size from fine powder to particles perhaps 1/16 in. in diameter. Fine, white powder has accumulated in the crevices of the fan outlet duct.

C. Changes are being made in the feeding setup to permit longer operation of the unit.

54AA

71576

### III. ALCLO STUDIES

#### A. PROPELLANT STUDIES

1. Inspection of the interfaces of six 3.75-in.-dia grains was conducted to determine the soundness of the interface and to see if the small irregular cracks noted on the bottom face of the first press of some grains were repeated in other interfaces. In all cases, the interfaces were intact and would have required an approximate force of 50 to 150 lb in tension to separate adjoining increments. None of the small irregular cracks in the bottom face were repeated in the 30 interfaces of the 6 grains inspected.

2. Work was continued on the quality control of the ingredients of Alclo with particular attention to the powdered lead. Particle-size distribution data are obtained for each new shipment so that selection can be made to insure uniform performance.

#### B. VERTICAL STEAM GENERATOR

A new and improved model of the VSG Mk II was placed in operation. An accelerated program of burning-rate study will be conducted as part of the quality control of the Alclo ingredients.

#### C. 400-TON PRESS

Sixty-two 3.75-in.-dia grains were produced during May. The grains averaged about 8.25 in. long and weighed approximately 9 lb each. About 5 days of production were lost because of modification to the press building.

### IV. GASOLINE AND COMPRESSED-AIR HYDROPULSE

A. Improvements in air-valve actuation and in fuel vaporization permitted a 50% increase in cycling speed (from 3.0 to 4.5 cps) and a 100% increase in thrust.

B. Figure 1 shows a pressure vs time curve for a typical hydropulse cycle during the present static operation of the motor. The curve is typical of those obtained in past hydropulse experience. The bubble overexpands to create an underpressure which draws in the next water charge.

C. The pressure trace shows the necessity for increasing the speed of valve closing. The opening rate appears satisfactory, but the slow closing permits the charge injected at 60 psi to expand to about 30 psi before it is ignited. Also, when pressures above 60 psig are used, the burned and expanded charge is so large that it fails to develop any underpressure, thus preventing the barrel from refilling with water for the next cycle. Necessary revisions to increase the valve operating speed are being considered, so that the charge can be ignited at peak injection pressure. This improvement will also permit the use of higher injection air pressure.



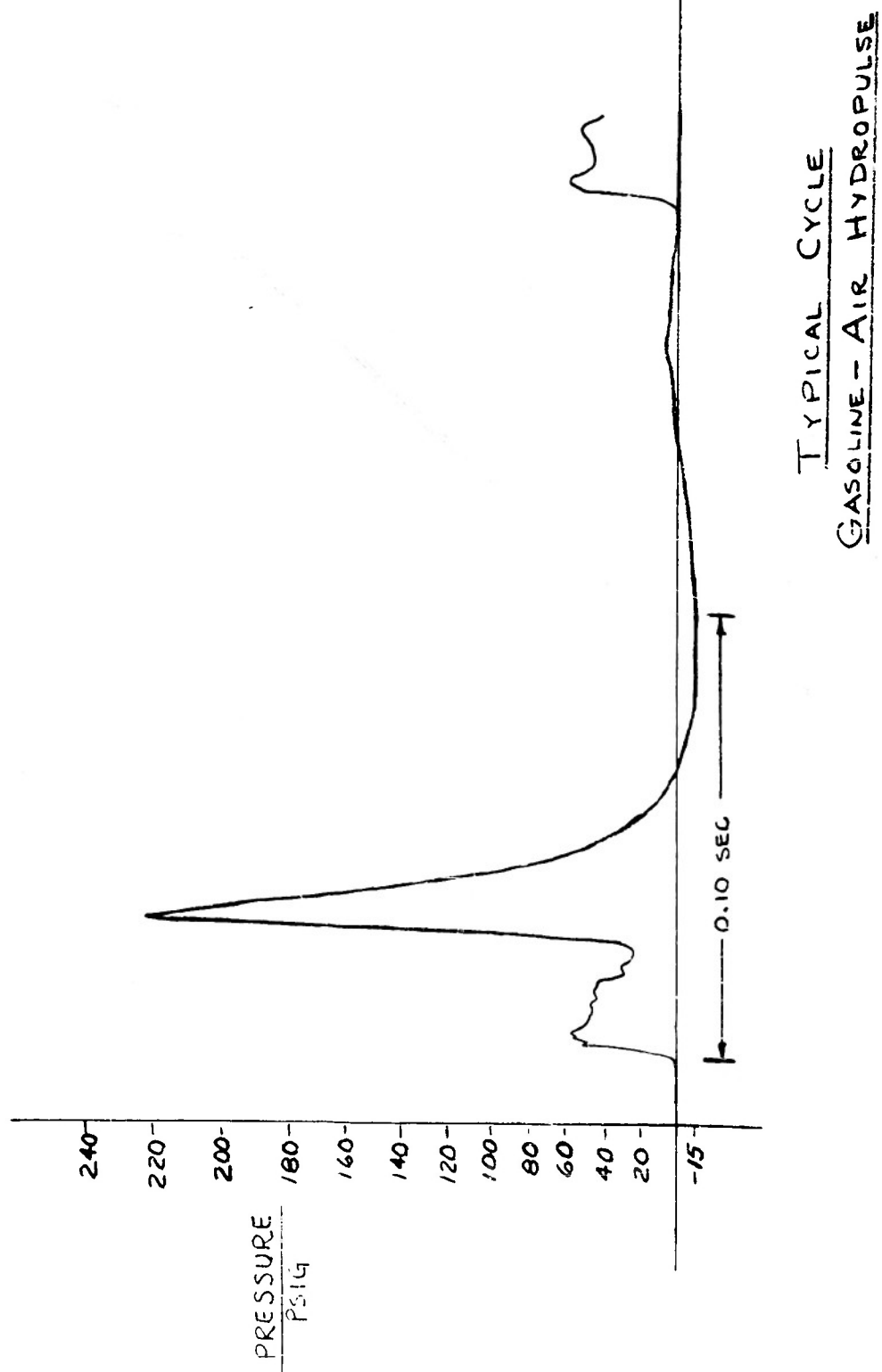


Figure 1

# Armed Services Technical Information Agency

Because of our limited supply, you are requested to return this copy WHEN IT HAS SERVED YOUR PURPOSE so that it may be made available to other requesters. Your cooperation will be appreciated.

**AD**

**46329**

**NOTICE: WHEN GOVERNMENT OR OTHER DRAWINGS, SPECIFICATIONS OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE U. S. GOVERNMENT THEREBY INCURS NO RESPONSIBILITY, NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.**

**Reproduced by**  
**DOCUMENT SERVICE CENTER**  
**KNOTT BUILDING, DAYTON, 2, OHIO**